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The Marine Fisheries Information Service : Technical and Extension Series envisages dissemination of information on marine fishery resources based on research results to the planners, industry and fish farmers, and transfer of technology from laboratory to field.

Bivalve fishery of Bhimili Estuary, Visakhapatnam, Andhra Pradesh

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The Bhimili Estuary situated in Visakhapatnam District of Andhra Pradesh is a fairly large but shallow estuary and supports the livelihood of over 5000 fishers. Nearly 3000 clam/oyster pickers exploit the bivalve resources of this estuary. Finfishes like *Mugil cephalus* and *Caranx* sp., shrimps such as *Metapenaeus monoceros, Fenneropenaeus indicus*, *Penaeus monodon* and the crab *Scylla serrata* are the major species contributing to the fishery of this estuary. The Gostani River joins the sea at Bhimilipatnam carrying freshwater from Anantagiri hills, Padmanabhan, Boni, Pandrangi, Taditorru, Gudivada, Chittivalasa,Jutmill,Mulakuddu and Nagamayyapalem. Clams and oysters are distributed up to a stretch of 5-6 km from Bhimili municipality office point. The clam/oyster fishing grounds are Moolakuddu, Magamayyapalem, Thotepalem, Chinnanagarama, Asipalem and Gudivada.

The clam/oyster fishery in the Bhimili Estuary is carried out throughout the year, except during the month of January due to cold conditions. Bivalve fishery in the Bhimili Estuary is a very recent activity. During the 1980-90's, the various uses of clams and oysters were unknown to the local people. Later, they began picking clams only for the consumption of meat. Much later, the commercial value of the shells for the preparation of lime was realised and active exploitation of bivalves increased. During 2000, the demand for clams increased and traders from Payakaraopeta, Yellamanchili, Narsipatnam and Nakkapali transported truck loads of clam and oyster shells. During this period, when the demand for shells was high, fishing was carried out by boats (known locally as Katlatheppa) with 3 - 4 persons per boat. Women and children handpicked clams from the inshore waters. Traders carried shells for lime industry and fertilizer. The meat of clams and oysters are being used by hatcheries in and around Bhimilipatnam, Srikkakulam and Kakinada. The meat is priced at and Kakinada. The meat priced at ₹ 80-150 per kg. The shells are priced at ₹ 6-8 per kg. The shells of *Anadara rhombea* have greater demand due to ornamental value.

Fishery

Three species of clams and one species of oyster contribute to the fishery of the Bhimili Estuary. *Meretrix casta* is the dominant species followed by *M. meretrix* and *A. rhombea*. The edible oyster *Crassostrea madrasensis* is exploited to some extent. The salient features of the bivalve fishery during 2003-2010in the Bhimili Estuary is presented here. The total bivalve production during 2003-10 was 4.7 t with an average annual production of 0.59 t. The total clam production during the period was 2.71 t with an average annual production of 0.34 t. The total effort expended was 80983 units with an average catch per unit effort of 58.1 kg. Among the clams, the dominant species was *M. meretrix*. The total production during the period was 0.53 t with an average annual landing of 0.07 t. *A. rhombea* was landed in meagre quantities of 0.04 t. Edible oyster *C. madrasensis* landed during the period was 1.99 t with an average annual production of 0.25t (Table 1). During 2003-'10, the total bivalve production in the Bhimili Estuary showed an increasing trend up to 2005, both in catch and effort. Thereafter, there was a decline in the fishery with 83.3% decline in 2007. In 2008, the fishery improved and increased significantly over the previous year but again declined thereafter. In 2010, the fishery again declined drastically. The effort also declined over the years from 14839 in 2003 to a meagre 2405 in 2010 (Fig. 1). Bad weather, as a result of frequent cyclones affected the exploitation which resulted in decline in production. The maximum landing of bivalves occurred during November followed by the period from March to June. In the case of *M. casta*, during 2003-'10, maximum landings occured during November (40.3 t) followed by 31.9 t in March, 30.7 t in April and 30 t in May. *M. meretrix* recorded the highest average monthly landing of 12.9 t in November followed by 7.8 t in June and 7.5 t in May. *A. rhombea* recorded highest average monthly landings of 0.87 t in November followed by 0.7 t in March and 0.65 t in April.

C. madrasensis recorded highest average monthly landing of 36.2 t in April followed by 35.2 t in March and 30.7 t in May (Fig. 2).

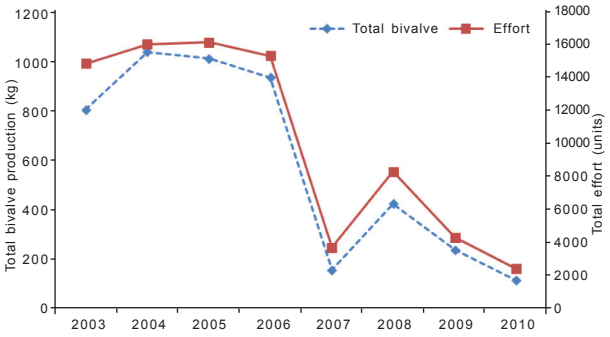

Fig.1. Bivalve catch and effort in Bhimili Estuary, 2003-2010

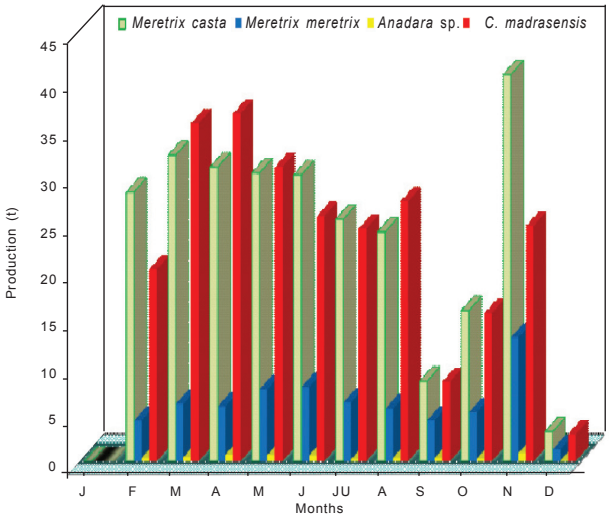

Fig. 2. Average monthly landings of bivalve species in Bhimili Estuary in 2003-2010

Table 1. Catch and effort of bivalve fishery in Bhimili Estuary, Visakhapatnam

Year	*M. casta* (kg)	*M. meretrix* (kg)	*Anadara* sp. (kg)	*C. madrasensis* (kg)	Total clams (kg)	Total bivalves (kg)	Effort (no. of units)	C/E (kg)
2003	541.5	62.4	7.5	190.7	611.3	802.1	14839	54.1
2004	559.1	113.5	8.9	353.8	681.6	1035.4	16002	64.7
2005	410.1	107.6	6.8	483.7	524.5	1008.2	16129	62.5
2006	347.8	86.7	5.5	492.2	440.0	932.3	15307	60.9
2007	73.5	15.1	0.7	66.1	89.3	155.4	3705	41.9
2008	106.8	76.7	4.1	235.4	187.6	423.0	8229	51.0
2009	57.6	45.1	4.0	130.0	106.7	236.7	4297	55.1
2010	40.0	23.9	2.0	47.8	65.8	113.6	2405	7.2
Total	2136.4	531.0	39.5	1999.6	2706.9	4706.5	80983	58.1
Average	267.1	66.4	4.9	250.0	338.4	588.3	10122.9	

The clam/oyster fishery has been declining over the past two years. The clam pickers are now switching over to crab fishing or prefer to go for daily wages activity in the bank colony, Tagapuvalasa and Timmapalem areas. Migration of the fishers to neighbouring states is another major social issue. The migrants earn nearly q 3500 in Chennai, Calcutta and Bangalore excluding food and accommodation. They return to their native villages once in six months. Many others are compelled to take up other income generating activities such as making and repair of boats and catamarans.

There are several issues affecting the sustainability of the bivalve fishery and the livelihood of the fishers dependent on the Bhimili Estuary. The exploitation of bivalves has been affected largely due to the inclement weather conditions such as cyclones and thunderstorms. The decline in production has led to socio-economic issues including migration. Pollution, mainly from domestic sewage has also been a major issue in the decline in production. Alternative income generating activities such as oyster/mussel/clam relaying should be introduced to solve the socio-economic problemsof the local fishers of this area.

Tuna fish waste as an aquafeed substitute at Visakhapatnam

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Tuna is an important group of large pelagics in the waters along the Visakhapatnam coast and constitute a major component of the exploited marine fishery resources. The annual average landings of tunas in Andhra Pradesh during 2006 -2010 was 29,360 t, which accounts for 26.4% of the national tuna catch. The highest catch of 32,369 t was recorded in 2009 and the lowest catch of 27,046 t was recorded in 2006. Visakhapatnam alone contributes to half the total tuna catch for the state. The tuna fishery at Visakhapatnam is contributed mainly by *Euthynnus affinis* and *Thunnus albacares* with small amounts of *Katsuwonus pelamis* and *Auxis thazard*. They are mainly exploited by hooks and line and by gillnets. They are locally called 'suralu' and support a regular fishery. Visakhapatnam is the major fishing harbour where tuna fish is brought from different landing centres and transported for export.

Guts and gonads of tunas account for 8% of the total body weight. Head, fins, mid bone, tails and gills of tunas contribute to 20- 25% of the total body weight. Hence 30-35% of the total body weight of tuna is waste and can be utilised in silage production. Smaller tuna *viz., E. affinis, K. pelamis* and *A. thazard* are processed and exported as whole fish. Yellowfin tuna weighing more than 15 kg are only degutted, deheaded, definned, detailed, degilled and exported as fillets. The average annual tuna waste generated at Visakhapatnam is estimated around 1,000 t (one fourth of the tuna caught at Visakhapatnam is only used for filleting).

The present paper reports the utilisation of wastes obtained from tuna at the Visakhapatnam Fishing Harbour (VFH). Very often, huge quantities of tuna wastes are dried at VFH. After the flesh of tuna is sliced and removed, the leftover head, thick midbone, fins, gills and viscera are dried properly in the drying yard of fishing harbour and regularly transported in gunny bags to Bhimili. The final dried product is sold at the rate of ₹ 15 per kg and utilised for the preparation of fish meal. The average annual returns to the fishermen community by selling sundried processed tuna waste is estimated as ₹ 4.5 crores. Thus it is an economic benefit as the waste generated is again reutilised in the preparation of aquafeed.

Similar scenario exists in Lakshadweep where, on an average, 3,000 t of tuna waste is generated annually. A novel attempt was made by Central Institute of Fisheries Technology (CIFT), Kochi to develop a technology of converting waste generated during processing of tuna into a liquid protein source for animal feed preparation and developing a fish feed under the brand name "SILO" which was found to be promising for cultivable marine finfishes like cobia, grouper and seabass. The same can be tried at Visakhapatnam keeping in view the huge amount of tuna waste generated and this will enable the fishermen community to realise much higher returns than that generated at present.

Fig.1. Tuna waste being sun dried near Visakhapatnam Fishing Harbour

Observations on the landing of *Odonus niger* at Mangalore

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The redtoothed triggerfish (*Odonus niger*) of the family Balistidae is a reef associated species landed by trawl nets operated along the Karnataka coast. This species forms dense aggregations in inshore waters and were not targeted till recently due to their poor market demand. The triggerfish shoals are intentionally avoided by the trawlers and the incidental catches are either discarded or brought ashore when there is available deck space for storage. Such small quantities landed are auctioned along with the miscellaneous fish groups. Some interest was evinced on this species by the fish meal traders due to limited availability of raw materials during the year 2008. Consequently, it was segregated onboard and preserved on the deck in fresh condition for auctioning separately. The triggerfish fishery along the Mangalore coast was monitored during January-May. The triggerfish landings increased from 84 t in January to 181 t in February and thereafter reduced to 13 t in May (Fig. 1). The catch rates in multi- night trawlers ranged from 200- 1500 kg unit^{-1}, and the quayside price realised was ₹ 4 per kg. The size range of the species in the commercial landing was 110 to 175 mm with 125-140 mm dominating the fishery (Fig. 2). The resource was mainly transported to fish meal plants in Kerala for being used as a constituent in poultry feed. Later in the year 2009, the species was landed along with the miscellaneous groups, except in January and February, due to the increased availability of oilsardines for fish meal plants.

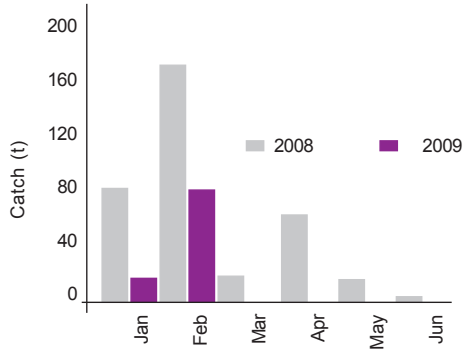

Fig. 1. Monthly landings of *Odonus niger* at Mangalore (2008-2009)

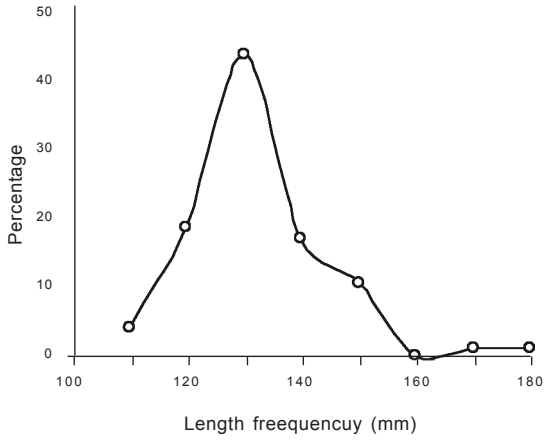

Fig. 2. Length composition of *Odonus niger* in the commercial landings

Fig. 3. Triggerfish heap on the deck of trawler

Fig. 4. Triggerfish ready for transportation

Heavy landing of unicorn leatherjacket *Aluterus monoceros* by trawlers at Tuticorin Fishing Harbour of the Gulf of Mannar

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Tuticorin Fishing Harbour (8.48° N, 78.11° E) is one of the major landing centres along the Gulf of Mannar coast of Tamil Nadu from where 65% of fish of Tuticorin District is landed. Every year, after 45 days monsoon ban from April 15th to May 30th, trawlers get good catches at the rate of 2 to 4 t per unit per day and this continues for 3 months. Unusually heavy landing of the filefish or unicorn leatherjacket, *Aluterus monoceros* locally known as "white klathi" occurred during July 2009. This was first noticed on 17th of July 2009 and the heavy landing lasted till the end of August. During this period, filefish was landed on an average of 1 - 3 t everyday by almost 35% of the observed vessels (Table 1).

Table 1. Details of *Aluterus monoceros* landings by trawlers at Tuticorin Fisheries Harbour

Date	Unit	Catch (t)
17th July 2009	201	76.21
27th July 2009	204	59.74
13th Aug 2009	199	118.80
20th Aug 2009	186	302.25
20th Aug 2009	182	79.99

During August 2009, the landing was heavy and the total catch of unicorn leatherjacket realised was 3,306 t at catch rate of 117.83 kg h^{-1} (Table 2). However, during subsequent months of September and October, the landings have come down but again good landing was noticed in November. Thereafter, filefish occurred in trawl catches in limited quantities till April 2010. However, when the trawl fishery resumed after the ban period in 2010, moderately good landing of filefishes was noticed in June 2010 and catches remained the same till August and got reduced in September-October and increased again in November 2010. Filefishes formed 53.9% of the trawl catch in August 2009 and 27.2% in August 2010.

The size of *A. monoceros* in the catch ranged from 47 to 59 cm in length (n=56) and from 750 g to 1.3 kg in weight. The fishes were purchased by local merchants at the rate of ₹ 50/ fish at the landing centre. Fishes were transported to Kochi for processing and exporting to Taiwan. About 4-5 truckloads each weighing 5 t were transported to Kochi during July and August 2009. The income realised by selling filefish alone per vessel ranged from ₹ 75,000 to ₹ 1.5 lakhs per day.

At Tuticorin, the mechanised trawlers start for fishing early in the morning at 0500 hrs, reach the fishing ground after 2-4 h of travel and after searching the trawling grounds, fishing operations will be carried out for 4 to 6 h. Three to four hauls will be taken on each day, each haul lasting for 1.5 - 2 h. As per the regulations imposed by the trawl boat owners association in consultation with state fisheries department, the boats have to return to the harbour on the same day before 2300 hrs.

Aluterus monoceros (Linnaeus, 1758) or unicorn filefishes under the family Monacanthidae are reef associated fishes. They have highly compressed body and occur in tropical and temperate waters generally as bycatch. The species is distributed in the western Indian Ocean, eastern Atlantic and eastern Pacific Ocean. These fishes have strong teeth to eat coral and hard rocks and the body is covered with rough textured scales. They feed mainly on benthic crustaceans, planktonic invertebrates, cnidarians, hard corals, benthic algae and weeds. They move solitarily or in pairs, occasionally in groups of five or six, at less than 10 m depth. Juveniles are bentho-pelagic, seen under floating objects. Adults and juveniles are rarely seen near reefs. Juveniles often move with large jellies and these may bring them close to reefs and adults may nest on sandflats adjacent to reefs in deep water. At other times, the adults may form large schools under weed-rafts. These fishes have very long (14 years) population douubling time and hence considered as highly vulnerable (Fishbase, 2009). Ciguatera poisoning is reported from these fishes.

Filefishes are considered as bathypelagic fishes and the fishes were abundant during July-August in the depth range of 40-60 m off Tuticorin. However, during subsequent months, the catch was reduced

as the fishes available in shallow waters were almost exploited by trawlers. At Tuticorin Fisheries Harbour alone, the landing of *A. monoceros* during 2009 was estimated as 5,313 t and in 2010 the landing was 1,359.8 t. There was report of heavy landing of *A. monoceros* during September-December 2010 at Chennai Fisheries Harbour especially in November 2010. The reason for the abundance of file fishes in large quantities in certain months along Tuticorin is not clear and hence need further investigation.

Fig. 1. Heap of filefishes landed at Tuticorin Fisheries Harbour on 17th July 2009

Table 2. Month-wise catch details of *A. monoceros* in trawls at Tuticorin Fisheries Harbour during 2009 and 2010

Month	Fishing effort (AFH)	Total trawl catch (t)	Filefish landing (t)	% in total catch	Catch rate (kg/h)	Depth of operation (m)
July (2009)	28800	6212.124	862.464	13.8	29.95	25-40
August	28065	6126.587	3306.877	53.9	117.83	40-60
September	29160	4400.088	197.056	4.4	6.76	60-110
October	31374	3073.614	33.384	1.0	1.06	70-225
November	18054	3231.004	886.690	27.4	49.11	70-150
December	16236	1173.458	26.928	2.2	1.66	100-150
Total	151689	24216.875	5313.399	21.94	35.03	
Jan (2010)	19404	3662.594	33.345	0.9	1.06	40-200
February	24398	3053.244	24.396	0.7	1.0	80-400
March	24983	2572.406	10.440	0.4	0.42	80-350
April	13140	1079.040	11.340	1	0.86	35-340
May	No fishing					
June	33412	4272.356	303.721	7.1	9.09	19-42
July	30464	3024.896	256.746	8.4	8.42	30-83
August	12607	1596.546	435.690	27.2	34.56	19-60
September	25555	3982.088	30.668	1.9	1.20	17-100
October	31013	4532.749	202.228	4.4	6.52	17-100
November	16742	1729.212	92.220	5.3	5.51	27-120
December	19832	1359.872	38.776	2.8	1.96	40-150
Total	251550	20515.719	1359.779	6.63	5.41	

Heavy landings of snappers at Mumbai with notes on the biology of *Lutjanus argentimaculatus* (Forsskal, 1975) and *Lutjanus johnii* (Bloch,1792)

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Snappers are considered valuable seafood delicacy and enjoy great demand in international market. Snapper landings in Maharashtra have increased over a period of time. The major species of snappers landed in Maharashtra is *Lutjanus johnii* which is accompanied by occasional landings of *Lutjanus argentimaculatus*. Apart from these, other species of snappers are also observed from Maharashtra waters, but their landings are meagre. Juveniles of snappers usually inhabit mangroves and shallow waters adjacent to sea shore but adults abode reefs and are sometimes caught from even 80 m depth in the sea.

An unprecedented high quantity of *L. argentimaculatus* was landed at Sassoon Docks on 23-10-2009 by purse seiners (Fig.1). *L. argentimaculatus* is commonly called as 'mangrove red snapper' and is locally known as '*chavri tamb*' in Maharashtra. The total catch of the species on the day was about 4.5 t and the fishing ground was south of Mumbai up to Ratnagiri in the depth range 40-50 m. As the size of each fish was fairly large weighing 1.5 – 2.5 kg, they were sold at the rate of ₹ 250/kg at the landing centre. Although landings of red snappers were common in Mumbai during October-November prior to 1990, the landing of *L. argentimaculatus* in such a magnitude is uncommon and hence the present observation gains importance.

Fig. 2. *Lutjanus argentimaculatus* landed at Sassoon Docks, Mumbai

In the present catch, the maximum size observed was 59 cm. *L. argentimaculatus* was identified by its distinct red brown colour. The dorsal fin has 10 spines and 13-15 rays while caudal fin is truncate and slightly emarginated with the soft parts of dorsal and anal fins having a scaly sheath. The species is very similar to *Lutjanus malabaricus* but the head profile of *L. argentimaculatus* is straight and slightly convex unlike *L. malabaricus*, in which the head profile is slightly concave.

Ten specimens of *L. argentimaculatus* ranging in total length from 50.2 to 59 cm with the corresponding weight ranging from 1.68 to 2.72 kg were analysed for further biological characteristics. Majority of the guts (60%) had little food or was in 'empty' condition and the remaining 40% were '1/4' full. The gut content revealed that it feeds mainly on crabs (50.8%) followed by fish (35.6%), cephalopods (8.5%) and digested matter (5.1%) beyond recognition. Of the 10 specimens analysed, 3 were females and the remaining were males. Among the females, one specimen had ovary with immature eggs while two specimens had maturing ovaries (stage III) weighing 15.9 to 16.1 g. The number of maturing ova in stage III ranged from 62,000 to 80,500.

Lutjanus johnii is commonly known as 'John's snapper' and is locally known as'*tamb*'. *L. johnii* was identified by its steeply sloped head and the centre of each scale with a reddish brown spot. A distinct large black blotch is present above the lateral line below the anterior dorsal fin rays.

An unprecedented high quantity of *L. johnii* was landed at Sassoon Docks on 04-11-09 by purse seiners (Fig. 2). The total catch of the species was about 3.2 t. They were sold at the rate of ₹ 200/kg at the landing centre. Over the years, the catch of this species has dwindled in alarming proportions in Maharashtra, but, of late, there seems to be a revival of the fishery. The landings were observed during October to March and peak landings of juveniles observed during January - March. The fishing ground for *L. johnii* in Maharashtra was south of Mumbai up to Ratnagiri in the depth range 40-50 m.

Fig. 2. Landings of *Lutjanus johnii* at Sassoon Docks, Mumbai

Thirty specimens of *L. johnii* ranging in total length from 31 to 56 cm with the corresponding weight ranging from 0.5 to 2.2 kg were analysed for biological aspects.Majority of the guts (51.4%) had little food or were in 'empty' condition followed by '1/4' (18.6%), '1/2' (11.8%) and 'full' (18.2%). The gut contents revealed that it feeds mainly on crabs (51.6%) followed by fish (26.2%), prawn (20.2%) and 2% was digested matter beyond recognition. The sex ratio was estimated as 1:0.3. In the catch, 85% of the specimens analysed were mature followed by gravid (15%). The number of maturing ova ranged from 45,500 to 1,90,500.

In view of prospects for open sea culture in cages, large snappers like *L. argentimaculatus* and *L. johnii* have assumed great importance in recent years. Owing to fast growth, delicately flavoured flesh, high market value and export potential, snappers are an

important species cultured in Indonesia and Thailand. Since both these species are highly commercial and can be cultured in captivity, biological studies on the species are required as there is not much biological work carried out on these species from Indian waters. Further studies on both the species are presently being carried out at Mumbai Research Centre of CMFRI.

Micro-agriculture techniques for the sustainable production of live feed organisms in the laboratory

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Indian coastal waters harbour diverse groups of microalgae or phytoplankton such as diatoms, dinoflagellates, blue green algae, silicoflagellates and cocolithophores together constituting nearly 95% of primary production in the marine ecosystem. In mariculture, these microalgae form the main live feed organisms during the early developmental stages of commercially important marine finfishes, crustaceans and molluscs. Hence marine hatcheries maintain stock cultures of diatoms and dinoflagellates for producing mass cultures for feeding requirements. The marine hatchery complex at Calicut Research Centre of CMFRI maintains stock cultures of eight species of live feed organisms (Table 1).

Like agronomic practices essential for the cultivation of field crops, certain micro-agriculture manipulations determine the sustainable production of microalgae in the laboratory. Growth of microalgae in the laboratory can be influenced by external environmental conditions such as light intensity, photoperiod, temperature, dissolved nutrients, minerals *etc.* These factors not only can affect the growt and multiplication of microalgae, but also their quality and accumulation of metabolites.

Light is one of the most important environmental factors affecting the growth rate of microalgae. Liao *et al.* (1983) demonstrated that the growth rate of *Skeletonema costatum* increased with light intensity progressing through 500-10,000 lux and declined at light intensity exceeding 10,000 lux. Most types of microalgae grow well at temperatures from 20 to 25 °C (Laing, 1991). For optimum growth rate and sustainable production of microalgae, the following conditions were optimised at our laboratory.

Table 1. Species of microalgae maintained at Calicut Research centre of CMFRI

Group	Species
Chlorophyceae	*Chlorella vulgaris*
Chlorophyceae	*Dunaliella salina*
Chlorophyceae	*Nannochloropsis oculata*
Chlorophyceae	*Nannochloropsis salina*
Bacillariophyceae	*Chaetoceros calcitrans*
Haptophyceae	*Isochrysis galbana*
Haptophyceae	*Dicrateria gilva*
Prasinophycea	*Tetraselmis gracilis*

Temperature is maintained at 23° C using two split air conditioners operated alternatively. Light is provided from fluorescent lamps kept 12 inches away from the culture flask to prevent cultures getting heated up due to prolonged illumination. Photoperiod is another important factor which was set to 12 h dark and 12 h light regime using a timer-switch. Before setting the photoperiod, the stock cultures were crashing very often during the onset of exponential phase itself.

Contamination is a menace to the stock cultures which is caused due to improper handling of culture flasks, cotton plugs, seawater, media as well as vitamins and inadequate sterilisation of culture flasks. To avoid contamination of the stock cultures, the culture flasks are cleaned thoroughly with excess water, rinsed with HCl, brushed with soap solution

and finally washed under running tap water. These flasks with the chlorinated, aerated and filtered seawater are autoclaved for 30 min, cooled and then nutrients and vitamin solution are added using syringe filters (2 µ). The cotton plugs wrapped with cotton gauze are labelled to avoid cross contamination. These cotton plugs are also periodically autoclaved.

Silicate supplement is required for the culture of *Chaetoceros* and other diatoms. In addition to normal dose of nutrients and vitamins as recommended by Walne, addition of 1 ml l^{-1} of 2 µM solution of sodium metasilicate enhances the growth rate and cell multiplication. Salinity of the medium is increased to 37-38 ppt for culturing Dunaliella salina as cultures at salinity levels lower than this fail to develop after inoculation.

Immobilisation or entrapping the microalgal cells in polyurethane film or styrene balls helps in easy transport, long term storage, saves inocula and minimises the risk of contamination. Carbondioxide (CO_2) bubbling to the cultures for one minute every day dispensed through sterilised tubular vents enhances the cell density to above 50% more than those flasks which did not receive CO_2. Serial dilution of stock cultures once in every fortnight is favoured to keep them axenic and pure. Contamination due to ciliates is a serious problem that can lead to collapse of the culture. Recouping the cultures with additional supplements of nutrients and vitamins after every six days prolongs the exponential phase of the cultures and thereby the time and labour involved in cleaning the glassware, preparation of fresh medium and inoculation can be saved. Two litre cultures are thus maintained for two months in our laboratory at the Calicut Research Centre of CMFRI.

Nutrient enrichment to the live feed culture is achieved by supplementing minerals (µM solutions of Sn, Mg, Ca, Bo, Mo and Zn) or growth hormones over the normal levels. These minerals and hormones are accumulated in the cultured algal cells. Such enriched feed organisms act as vehicles carrying additional levels of minerals, hormones and amino acids to their consumers through feeding aimed at imparting certain desirable traits. Organic culture of live feed organism without using inorganic salts as source of nutrients is also possible by substituting sterilised garden soil extracts and blended seaweed extracts (Kaladharan *et al.,* 2002). While garden soil extracts offer major nutrients, seaweed extracts do offer immunostimulants besides vitamins and natural growth stimulants. By optimising the physical, chemical and environmental conditions for the cultures, the quantity and quality of live feed cultures in the laboratory can be increased considerably.

Bumper landings of skipjack tuna (*Katsuwonus pelamis*) by hooks and lines at Visakhapatnam Fishing Harbour

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Regional Centre of CMFRI, Visakhapatnam

Bumper landings of skipjack tuna, *Katsuwonus pelamis* was observed at Visakhapatnam Fishing Harbour on 28th October 2011, wherein about 42 t were landed by hooks and lines (Fig.1).

On this day, climatic conditions changed drastically wherein the direction of wind changed from north-east to south-east and the wind speed increased from <10 m/sec to 10-15 m/sec. The

Fig. 1. *Katsuwonus pelamis* landed by hooks and lines at Visakhapatnam Fishing Harbour

current pattern was hence in the same direction as that of wind, as because in the east coast during the onset of winter, the direction of current is from south-east.

About 80% of the catch was landed by the non-motorised sector and the remaining 20% by motorised crafts. The landings were from three fishing villages *viz*., Jalaripeta, Uppada and Bheemunipatnam with an average catch of 250 kg/craft. Each line of length varying from 200 to 300 m was equipped with 10 to 20 hooks, operated at a depth of 70 to 100 m. The other species landed in association with skipjack tuna were yellowfin tuna (*Thunnus albacares*), sailfish (*Istiophorus platypterus*), marlin (*Makaira indica*), dolphinfish (*Coryphaena hippurus*), carangids *(Caranx* sp.) and spotted seer fish (*Scomberomorus guttatus*) with catches of 2 t, 1.75 t, 1.25 t, 0.3 t , 0.075 t and 0.07 t, respectively.

The length of *K. pelamis* landed varied from 440 to 650 mm FL with corresponding weight ranging from 1333 to 4700 g. Biological investigations revealed that majority of the stock were in spent and recovery phase. Catch was auctioned at a price of ₹ 50-60 /kg to the fish merchants. The sudden reversal in wind direction associated with the current pattern in the same direction could have influenced the movement of the species which have migrated from offshore to nearshore waters, hence accounting for this sudden increase in catch. Moreover skipjack tuna is known to breed in deepsea along the east coast during July - August and then migrate to coastal waters for feeding during the winter months, which could also have contributed to this sudden increase in catch. This is further substantiated by the fact that in majority of the fishes (55%), the gut was in gorged condition. The catch was negligible during previous couple of months, wherein a total of 5 t were landed together from mid of August to mid of October. This is the highest reported landing of skipjack tuna from Visakhapatnam Fishing Harbour on a single day.

First record of the chimaeroid, *Rhinochimaera atlantica* at Kasimedu Fisheries Harbour, Chennai

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Research Centre of CMFRI, Chennai

Chimaeras are shark like fishes having large head and elongated body that taper to a whip-like tail. They come under the subclass Holocephali, characterised by the fusion of the upper jaw to the cranium and absence of scales. Unlike sharks and rays (Elasmobranchii), chimaeras have only 4 pairs of gill openings which are hidden by a pair of soft gill covers, that extend to the base of the pectoral fins and a single external gill opening on each side of the head (Table 1). On 21-01-2010, a female long nose chimaeroid, *Rhinochimaera atlantica,* measuring 150 cm and weighing 8 kg was landed at Kasimedu Fisheries Harbour, Chennai which was caught from a depth of 50-80 m by mechanised gillnet (Fig. 1 and 2).

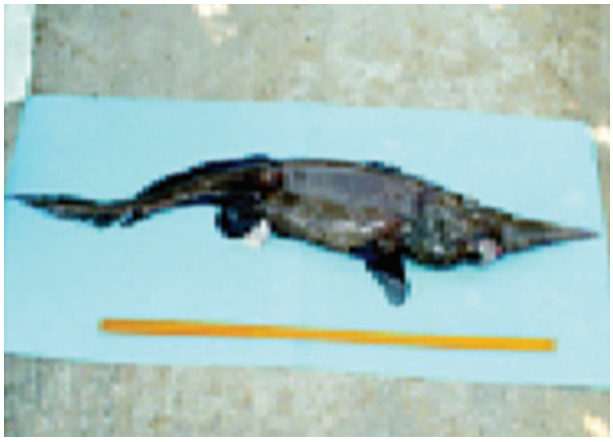

Fig.1. *Rhinochimaera atlantica* landed at Kasimedu Fisheries Harbour

Table 1. Morphometric measurements (cm) of *Rhinochimaera atlantica* landed at Kasimedu Fisheries Harbour, Chennai

Total length	150	2nd dorsal inner margin	1
Standard length	121	Pelvic fin anterior margin	12
Snout to origin of 1st dorsal	71	Pelvic fin posterior margin	6
Snout to origin of pectoral	48	Pelvic fin inner margin	1
Snout to origin of anal	110	Anal fin anterior margin	8
Snout to origin of head	47	Anal fin posterior margin	6
Snout to origin of eye	3.2	Anal fin inner margin	1
1st dorsal anterior margin	9	Length of upper caudal fin	26
1st dorsal posterior margin	9	Length of lower caudal fin	33
1st dorsal inner margin	1	Weight	8 kg
2nd dorsal anterior margin	4	Sex	F
2nd dorsal posterior margin	43		

The specimen was a mature female with four numbers of ripe oocytes, measuring 6 cm in diameter. Stomach was full and contents were in semi-digested condition. Other than the report on occurrence of two chimaeroid egg capsules off Tuticorin, Gulf of Mannar from commercial deepsea catch at a depth of 250-400 m (Arumugam *et al*., 1990), this is the first report on the landing of chimaeroid from south-east coast of India.

Fig. 2. Digestive system of the female chimaeroid, *R. atlantica* landed at Kasimedu Fisheries Harbour

Bopyrid parasite *Epipenaeon ingens* (Nobili, 1906) (Bopyridae, Isopoda) infestation in penaeid shrimps of Cuddalore coast, Tamil Nadu

P. Thirumilu

Research Centre of CMFRI, Chennai

While observing the regular landings of penaeid shrimps by mechanised trawlers at Cuddalore Fisheries Harbour, species belonging to *Parapenaeopsis stylifera* and *Metapenaeopsis stridulans* were found infected with the bopyrid parasite, *Epipenaeon ingens* (Nobili, 1906) during June, July and November 2010. Details on the extent of parasitic infestation are given in Table 1.

In *P. stylifera*, the percentage of parasitation varied from 13.5 to 14.6 in males and 9.7 to 20.8 in females during pre-monsoon months (June-July), while it was 68.4 and 26.1 in males and females respectively during the monsoon month (November). In *M. stridulans*, the parasitation ranged from 20 to 41.7% in males and 20.8 to 27.5% in females during pre-monsoon months and 9.8% in males and 27.4% in females during November. During the three months of observation, infestation in males of *P. stylifera* registered 30.2%, when compared to 16.7% in females. However, in *M. stridulans*, more females were affected (27.4%) as compared to males (19.3%). Earlier records of presence of *E. ingens* in Indian penaeid shrimps are reported in *P. stylifera* from Malabar coast, *Metapenaeopsis stridulans, M. mogiensis, P. stylifera* and *Parapenaeopsis maxillipedo* from Chennai, *Penaeus monodon* and *P. stylifera* from Parangipettai,

Penaeus semisulcatus from the Gulf of Mannar and Palk Bay, *Fenneropenaeus indicus* and *Solenocera crassicornis* from Kakinada and *P. monodon* from West Bengal. Though the bopyrid parasitation in penaeid shrimps was noticed in most of the months in a year during the present observation as well as from the earlier published accounts, a detailed study may throw more light on the preferential period of occurrence of parasite and its effect on the physiological status of these commercially important crustaceans.

Table 1. Infection of bopyrid parasites in penaeid shrimps landed at Cuddalore Fisheries Harbour

Period	Species	Nos. examined		Nos. affected		Percentage of parasitation		Size range of shrimp (TL mm)	
		Male	Female	Male	Female	Male	Female	Male	Female
June 2010	*P. stylifera*	37	48	5	10	13.5	20.8	71-95	86-103
	M. stridulans	65	91	13	25	20	27.5	65-95	76-98
July 2010	*P. stylifera*	41	62	4	6	14.6	9.7	75-90	65-101
	M. stridulans	24	51	10	14	41.7	27.5	81-95	76-90
Nov. 2010	*P. stylifera*	38	46	23	6	68.4	26.1	86-90	66-85
	M. stridulans	61	73	6	20	9.8	27.4	60-81	55-88

Fig. 1. *P. stylifera* (a) and *M. stridulans* (b) infected with *Epipenaeon ingens*

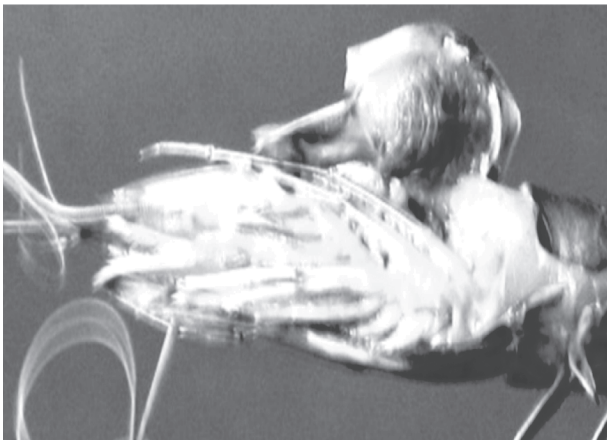

Fig. 2. Close-up view of *E. ingens* on *P. stylifera*

First record of *Sicyonia parajaponica* Crosnier, 2003 along Chennai coast

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Research Centre of CMFRI, Chennai

The miscellaneous catches from the trawlers operating in the inshore waters (40-60 m depth) off Chennai coast consist of smaller sized crustaceans such as penaeid shrimps (belonging to the genera *Penaeus, Fenneropenaeus, Metapenaeus, Parapenaeopsis, Metapenaeopsis, Trachypenaeus, Megokris, Trachysalamprica, Parapenaeus,* *Sicyonia* and *Solenocera*), brachyuran crabs, cephalopods and fishes, which are usually dried on the beach and utilised as one of the ingredients for poultry feed. The common species of *Sicyonia* encountered is *Sicyonia lancifer*, which has the characteristic two blue spots in the integument between carapace and abdomen (Fig.1).

On 10 - 03 - 2011, four specimens (two males: 64 and 67 mm in total length; 15 and 18 mm in carapace length, CL and two females: 60 and 68 mm in TL and 18 and 19 mm in CL) of *Sicyonia*, which differed from *S. lancifer* by having a round spot near the posterior border of carapace (Fig. 2a and b) were obtained. On closer scrutiny, they were identified as *Sicyonia parajaponica* Crosnier, 2003. In the present specimen of *S. parajaponica*, the rostrum possesses 9 dorsal and 2 ventral teeth and the median carina on first and second abdominal segments are sharp and elevated. The entire body is covered with scattered large brown tubercles.

S. parajaponica was described by Crosnier in 2003 while reviewing the taxonomical status of *Sicyonia* species occurring in the Indo-West Pacific, based on the specimens obtained from the Philippines. According to Crosnier (2003), *S. parajaponica* has been recorded from the Gulf of Aden, Phuket in the Andaman Sea, the Philippines, Australia, China and Taiwan. The present record from Chennai coast is the first report of the species from Indian waters.

Fig. 1. *Sicyonia lancifer*

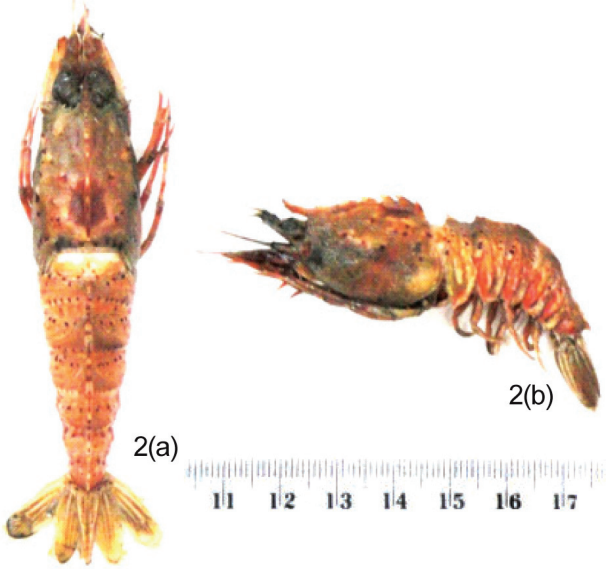

Fig. 2. a and b. *Sicyonia parajaponica*

Largest recorded ridge-back lobsterette, *Nephropsis carpenteri* Wood-Mason, 1885 from Chennai coast

P. Thirumilu
Research Centre of CMFRI, Chennai

Deepsea catches landed on 10-02-2011 by larger trawlers at Kasimedu Fishing Harbour, comprised deepsea penaeid shrimps (15% - *Aristeus alcocki*, *Metapenaeopsis andamanensis, Solenocera hextii)*, pandalid shrimp (25% - *Heterocarpus woodmasoni)*, nephropid lobster (40% - *Nephropsis carpenteri)* and fishes (20%). These larger trawlers were operating in the depth range of 200-400 m off Chennai. The size range (total length) for *N. carpenteri* was 45-110 mm

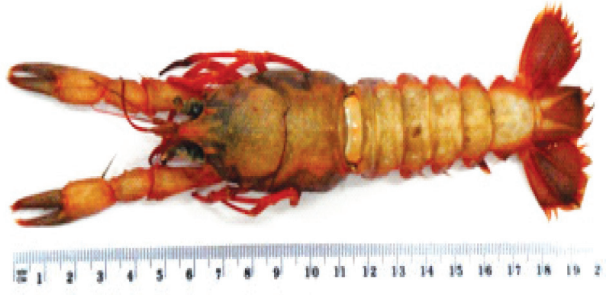

Fig. 1. *Nephropsis carpenteri* from Chennai coast

for males and 61-154 mm for females. According to Alcock (1901), the size of type specimen of Wood-Mason, 1885, who described *N. carpenteri* from the south-east of Chennai (lat. 13° 51'12" long. 80° 28' 12"E) was 101.5 mm in total length and 33.5 mm in carapace length, which was an egg-laden female. George (1966) recorded 113 mm for an egg-bearing female off Alappuzha, south-west coast, while Holthuis (1991) reported a maximum size of 120 mm for the species. Thirumilu and Rajan (2003) recorded size range of 62 to 124 mm total length for *N. carpenteri* caught off Puducherry and Tamil Nadu coasts. The present record of 154 mm total length and 48 mm carapace length for an egg-bearing female appears to be the largest size recorded so far for *N. carpenteri.* The colour of fresh specimens of *N. carpenteri* is generally light grayish yellow, while the integument at joints of chelipeds are with red bands. The pereiopods and pleopods are reddish. The lower border of abdominal segments on both sides and telson are also red in colour. *N. carpenteri* can be identified from the closely related species such as *Nephropsis stewarti* by the presence of middorsal carina in 3rd to 6th abdominal segments in the former *(N. carpenteri)* and its absence in the latter *(N. stewarti).*

Unusual landings of cusk eel *Monomitopus nigripinnis* at Chennai

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Research Centre of CMFRI, Chennai

At Kasimedu Fishing Harbour, Chennai, about 40-50 multiday thangal trawlers operate regularly. Out of this, 3-6 trawlers operated daily for deepsea prawns during the period Feb - April, 2008. Deepsea fishes were landed along with deepsea prawns. An unusually high catch of the cusk eel *Monomitopus nigripinnis* (Family: Ophidiidae) was recorded during the said period. The deepsea fishing operations were carried out in the south-east direction within a distance of 40-60 km at a depth of 150-200 fathoms. The same species came in 2009 also in low quantities. Fishes of this family are known to occur along the Indian coast. A list of the different species of Ophidiidae recorded from Indian waters is given in Table 1.

The size of *M. nigripinnis* landed at Chennai varied from 216 to 415 mm TL, with dominant mode at 300-319 mm. The weight ranged from 72-415 g. Most of the fishes had empty stomachs. Fishes with food in the stomachs showed a dominance of deepsea prawns. Fishes in fresh condition, are sold at ₹ 50/kg, and used for human consumption. Fishes in spoilt condition were sold at ₹ 20/kg and used for preparing dry fish and fish meal.

Table 1.Species of ophidiidae occuring in Indian waters

Species	Area of occurrence
Bassozetus gletinosus	Off Madras coast and Bay of Bengal
Brotula multibarbata	Indian Ocean
Enchelybrotula paucidens	Indian Ocean
Glyptophidium argenteum	Off Malabar coast
Holcomycteronus pterotus	Indian coast
Monomitopus cenjugator	Off Malabar coast
Monomitopus nigripinnis	Bay of Bengal
Neobythites statiticus	Bay of Bengal
Tauredophidium hextii	Indo-west Pacific and Malabar coast

Source: Fish base, 99

Fig. 1. *Monomitopus nigripinnis* landed at Chennai

Indiscriminate fishing of juveniles of commercially important fishes by minitrawlers and boat seines at Chombala Fisheries Harbour, Kerala

K. Chandran and K. C. Pradeepkumar
Research Centre of CMFRI, Calicut

Chombala Fisheries Harbour is meant for operating traditional crafts and became operational since May 1999. The harbour is situated at lat 11^0 39' 729" N and long 075^0 33' 062" E between Vadakara and Mahe. About 500 units of country crafts can safely anchor inside the harbour during the rough season. This facility is the main attraction for the fishermen in and around Chombala fishing village. Since the harbour has good marketing facilities, fishermen are getting better returns for their catch. Country crafts from fishing villages starting from Thikkodi to Mahe are utilising this harbour. Major gears under operation from this harbour are inboard ring seine 35 units, outboard ring seine - 30 units, mini trawl net - 125 units, pair trawl net - 50 units, driftnet - 50 units, boat seine- 100 units, gillnet - 150 units and 80 units of single day trawlers. Fishing is carried out throughout the year and during the monsoon period, *i.e.*, during June to August intensive fishing activity takes place. Crafts and gears from the adjacent landing centers camp at Chombala for monsoon fishing operations.

Juvenile fishing by minitrawl net and boat seine are frequently observed. During the month of March 2011, it was observed that about 25 units of minitrawlers were regularly bringing juveniles of fishes which were being discarded in the beach after selecting marketable size fishes (Fig. 1) On an average, 5 kg of such discard fishes were brought to the shore regularly. The amount of discard would be higher than actually landed, since they were bringing the catch only from the last haul to the shore without sorting. From local enquiry, it was informed that the same type of fishing continued till the last week of April 2011. During subsequent observations at Chombala Fisheries Harbour on 25-7-2011 and 26-7-2011, 34 and 21 units of boat seines landed 850 and 500 kg of juvenile *S. longiceps* of length ranging from 40 to 80 mm respectively.

Table 1. Size range of fishes landed at Chombala Fisheries Harbour

Species	Length range (mm)
Pampus argenteus	30-55
Lactarius lactarius	40-45
Metapeneaus dobsoni	35-40
Parapeneneopsis stylifera	35-40
Polynemus sp.	40-50
Arius sp.	40-45
Otolithus sp.	45-45
Leiognathus sp.	25-30
Opisthopterus tardoore	40-45
Cynoglossus sp.	45-50
Sepiella sp.	26-28
Johnieops sp.	35-40
Sphyraena sp.	90-95
Terapon sp.	40-45
Scatophagus argus	40-45
Pomadasys maculatum	40-45
Portunus sanguinolentus	20-30
Scombroides sp.	70-75

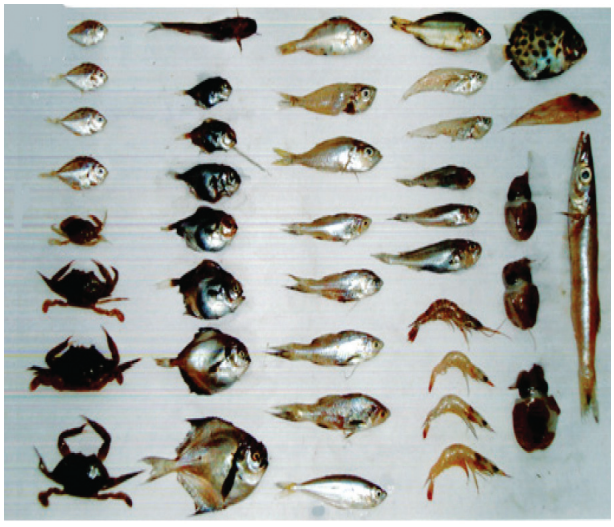

Fig. 1. Juvenile fishes landed by minitrawl net at Chombala Fisheries Harbour

First record of tawny nurse shark, *Nebrius ferrugineus* (Lesson,1830) from the north-west coast of India

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Research Centre of CMFRI, Mumbai

Sharks contribute about 2% towards the total marine fish landings in India and are fished mainly by hooks and lines. They are also caught by gillnets, trawls and purse seines as bycatch. Sharks are widely hunted for flesh, liver oil and fins which are mostly exported to south-east Asia.The species composition of sharks in Maharashtra comprised of *Scoliodon laticaudus* (86.2%), *Rhizoprionodon oligolinx* (3.9%), *Rhizoprionodon acutus* (0.7%), *Carcharhinus sorrah* (2.2%), *Carcharhinus limbatus* (1%), *Carcharhinus macloti* (0.1%), *Lamiopsis temminkie* (2.6%), *Sphyrna lewin*i (2.2%) and *Galeocerdo cuvier* (0.7%).

On 05-12-2010, a female shark measuring 3.2 m in total length and weighing approximately 42 kg was caught by a multiday trawler from a depth of 45-65 m and was landed at New Ferry Wharf (Fig. 1). The auction that followed realised an amount of ₹ 22,000/- at the landing centre.The specimen was identified as *Nebrius ferrugineus* (Lesson, 1830). It is commonly known as 'tawny nurse shark' which belong to the order Orectolobiformes, family Ginglymostomatidae and is the only extant member of the genus *Nebrius*. The present observation is the first record of this species from the north-west coast of India.

The specimen has a robust, cylindrical body and is characterised by moderately long barbels, nasoral grooves and the mouth is well in front of eyes. The eyes are lateral, spiracles minute and the first dorsal fin is far behind and is over the pelvic fins. The pectoral fins are falcate and the upper caudal lobe is moderately long. Generally these sharks inhabit reefs and are found at a depth of 70 m.

Fig. 1. *Nebrius ferrugineus* (Lesson, 1830) landed at New Ferry Wharf, Mumbai

Unusual occurrence of large size oilsardine (*Sardinella longiceps*) at Karwar, Uttar Kannada coast of Karnataka

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Research Centre of CMFRI, Karwar

The oilsardine, *Sardinella longiceps* (Valenciennes, 1847), is a major pelagic fishery resource of Malabar and Konkan coast. At Karwar, the fishing season for oilsardine is from August-May and the peak season is from October to March. During the current year, after the ban period, the oilsardine fishery by the purseseine boats started from the first of August, 2011.

In the second week of October, on 17th, it was observed that among the oilsardines landed by purseseiners, about 5-6% of fishes were unusually long, including a longest ever observed large sized

oilsardine in the landings (Fig. 1). On 20th October 2011, there were reports in the local daily news papers that large sized oilsardines were caught in purseseines near Karwar coast. The local media persons also gave wide publicity to this. On 20th October 2011, the fishermen of Karwar observed about 3-4% of fishes of unusually long sizes in their purseseine catches. The trend continued till the end of the month.

These specimens were collected off Karwar at a depth of about 30 m. The purseseine catch on that day consisted of oilsardine along with rays, flatfishes and carangids. Samples of oilsardine were brought to the laboratory of CMFRI, for further investigations. The longest specimen was a male adult in spent stage, which measured 240 mm in total length and weighed 127g in wet condition. The morphometric measurements of the specimen were recorded (Table 1) and gut content was analysed. The gut content mainly comprised of phyto and zooplankton.

Table 1. Morphometry of the large sized oilsardine landed at Karwar

Morphometric parameter	Measurement (mm)
Total length	240
Fork length	212
Standard length	230
Depth of body at dorsal fin origin	45
Depth of body at anal fin origin	30.5
Maximum body depth	46.2
Caudal peduncle depth	13
Head length	62.6
Snout length	17
Eye diameter	11
Inter-orbital width	16.2
Upper jaw length	18
Tip of snout to origin of dorsal fin	92.1
Tip of snout to origin of pectoral fin	60.1
Tip of snout to origin of pelvic fin	110.2
Tip of snout to origin of anal fin	114
Distance between pelvic fin to anal fin	26.0
Length of first dorsal fin base	26.0
Pectoral fin length	29.0
Pelvic fin length	16.0
Length of anal fin base	24.0

Fig. 1. The unusually large size oil sardine (*Sardinella longiceps*) landed at Karwar

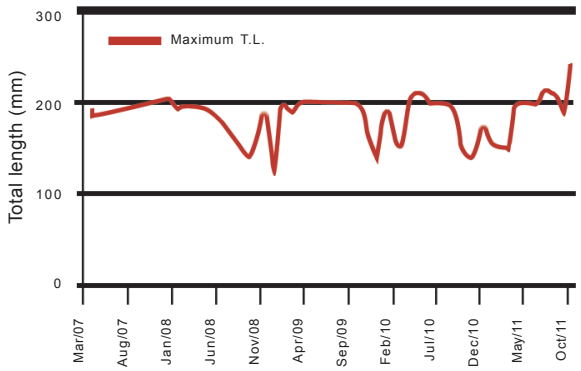

Fig. 2. Maximum lengths (total length) of oilsardine recorded in Karwar Landing Centre during 2007-2011

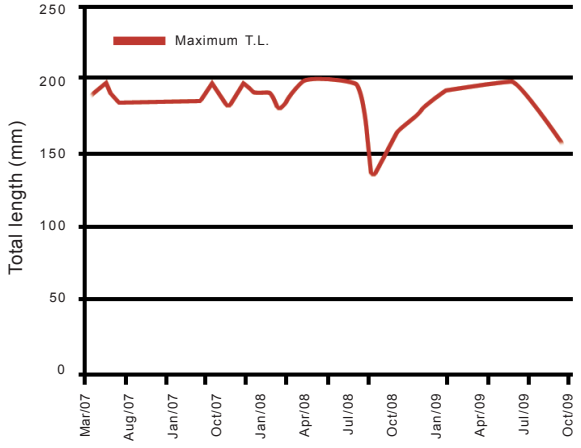

Fig. 3. Maximum lengths (total length) of oilsardine recorded in Tadri Landing Centre during 2007-2009

The maximum size of oilsardine recorded from seas around India is 272 mm (Prathibha Rohit, 2003). The largest ever recorded oilsardine (*Sardinella longiceps*) from Indian waters was landed by a purseseiner at Malpe Fishing Harbour in Karnataka. The length of oilsardine reported in Fishbase 1999 (http/www/ fishbase.org) is 23 cm (standard length). FAO species Identification sheets for fishery purposes, Western Indian Ocean, Fishing Area 51, 1984 has reported that oilsardine attains a maximum body length of 20 cm (possibly 23 cm).

From the past five year's observations, during March 2007-2011, it was found that the size range for this species was 75 to 211 mm from Uttar Kannada coast (Fig. 2 and 3). The specimen recorded in the present report is the largest specimen of oilsardine *(Sardinella longiceps)* ever recorded from Uttar Kannada coast.

Largest goatfish, *Upeneus moluccensis* (Bleeker, 1855) caught off Visakhapatnam

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Regional Centre of CMFRI, Visakhapatnam

Goatfish constitute an important demersal fishery resource landed at Visakhapatnam Fishing Harbour. They formed 14.4% of the trawl landings of the harbour and comprised of *Upeneus vittatus* (57.0%), *Upeneus sulphureus* (24.6%), *Upeneus moluccensis* (18%) and *Upeneus tragula* (0.4%). *Parupeneus heptacanthus* and *Parupeneus indicus* occur rarely in the fishery. During 2005 - 2009, the annual goatfish catch of Visakhapatnam Fishing Harbour was in the range of 2177 - 3463 t with an average catch of 2859 t. The annual average landings of *U. moluccensis* during 2005 -'09 was 515 t forming 18% of the total goatfish catch at the fishing harbour. They are mainly exploited by bottom trawlers along with marginal exploitation by both drift and bottom set gillnets.

Fig. 1. *Upeneus moluccensis*

During the last week of August and first week of September 2010, multiday trawling boats landed large sized gold band goatfish, *U. moluccensis* at Visakhapatnam Fishing Harbour. The local name of the gold band goatfish is 'pasupugulivand'. A large goatfish ever caught at Visakhapatnam coast measured 211 mm in total length and weighed 121 g.

Table. 1. Morphometric measurements (mm) of the large sized goat fish *U. moluccensis* landed at Visakhapatnam

Parameters	Measurements (mm)
Total length	211
Fork length	196
Standard length	175
Predorsal length	78
Preanal length	116
Prepelvic length	60
Prepectoral length	58
Preorbital length	21
Head length	54
Eye diameter	13
Caudal height	35
Maximum height of the body	49
Length of first dorsal fin base	26
Length of second dorsal fin base	24
Length of pelvic fin	31
Length of pectoral fin	44
Length of anal fin	23
Eye diameter	13
Wet weight	121g
Sex and maturity stage	Female, VII a

It was caught as trawl bycatch on 4th September, 2010. Earlier Vivekanandan *et al.* (2003) recorded the goatfish *U. moluccensis*, with a maximum length of 189 mm caught at Chennai coast. The maximum length recorded by Fishbase is 200 mm (Sommer *et al.,* 1996). The present specimen is larger than those reported earlier.

Heavy landings of bigeye and pinjalo snappers at Chennai Fisheries Harbour

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Among the major perches landed at Chennai Fisheries Harbour, snappers and rock cods formed dominant groups followed by pigface breams. Among snappers, more than 15 species were recorded at Chennai Fisheries Harbour during 2009 (Table 1). In trawlnet, *Lutjanus lutjanus* (29.9%) formed the dominant catch followed by *L. rivulatus* and *L. malabaricus*. In mechanised gillnet, *L. rivulatus* (33.7%) formed the major catch followed by *L. malabaricus* and *Pinjalo pinjalo*. In hooks and line, *L. rivulatus* (34.4%) formed the major catch followed by *L. lutjanus*, *L. malabaricus* and *L. argentimaculatus.* The other lutjanids landed were *Aphareus rutilans, Aprion virescens* and *Pristipomoides filamentosus. Lutjanus lutjanus* was landed throughout the year by trawl nets. Unusually heavy catch of big eye snapper *(L. lutjanus)* was landed, about 8.5 t, 3.2 t, and 2 t by multiday *thangal* trawlers during July, August and September, 2009, respectively. Heavy landings (1.2 t) of *L. lutjanus* by multiday *thangal* trawlers at Chennai Fisheries Harbour was observed on 23-07-2009. Fresh fishes were auctioned at ₹ 60/kg. Eighty specimens *of L. lutjanus* were collected and analysed for biological aspects. The size ranged between 130 and 289 mm with weight range of 30-270 g, 53.3% of females were mature and others were immature. Stomach contents comprised prawn (50%), crab (30%), *Stolephorus* spp. (6%), others (14%) and most of the stomachs was half full.

On 07.07.2011, juveniles of *L. lutjanus* (1.5 t.) were landed by multiday *thangal* trawlers. Sample of 140 specimens of *L. lutjanus* were collected for biological studies. The size ranged between 80-209 mm and the weight range was 9-140 g; females were immature. Gut contents comprised of prawns (40%), crabs (35%), *Stolephorus* spp. (8%), and others (17%). In most of the fishes, stomach was empty.

Among the snappers, *Pinjalo pinjalo* locally called as “periya kizhichan”, formed 9.3%, 10.2%, and 8% of the total fish catch by trawlnet, mechanised gillnet and hooks and line respectively. Unusually, on 19-02-2011, heavy landing of large sized *P. pinjalo* of about 1.6 t were landed by mechanised gillnets. The size range of *P. pinjalo* was 480-680 mm with dominant mode at 620 mm. The weight ranged from 4.5 to 6.5 kg. The fishes were auctioned at ₹ 200/kg .

Fig. 1. *Lutjanus lutjanus*

Fig. 2. Catch of *Pinjalo pinjalo* at Chennai Fisheries Harbour

Table 1. Species composition of snappers landed by various gears at Chennai Fisheries Harbour in 2009

Species	Trawl net (%)	Mechanised gillnet (%)	Hooks and line (%)
L. lutjanus	29.9	0.0	17.8
L. rivulatus	21.6	33.7	34.4
L. malabaricus	13.5	28.8	15.5
L. argentimaculatus	3.1	9.9	8.3
L. russelli	7.3	5.0	3.8
L. bohar	4.4	2.0	2.7
L. fulviflamma	2.0	4.2	1.5
L. fulvus	2.0	1.8	1.0
L. johnii	2.3	0.8	3.3
L. quinquelineatus	1.5	0.2	1.5
L. gibbus	1.6	2.8	1.0
L. sebae	1.0	0.0	0.5
P. pinjalo	9.3	10.2	8.0
Other lutjanids	0.5	0.6	0.7
Total	100	100	100

Pair trawling at Sakthikulangara

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In 2011, the medium sized fishing boats operating from Sakthikulangara opted for a different mode of fishing. During this period, usually they used to have a good catch of *Parapenaeopsis stylifera* and other prawns but the catch existed for a shorter period. This prompted these fishermen to opt for a different mode called pair-trawling (local term *Nikathipani),* in which two boats operate as a single unit with 10-12 crew members. The gear used is a trawl net of mesh size 200-160-120-80-40-15 mm (code end mesh size). This gear is characterised by large floats tied towards the mouth part and towards the bottom three stones are

Fig. 1. Net used for pair trawling at Sakthikulangara

Fig. 2. *Pampus argenteus* landed by pair trawling at Sakthikulangara

tied - the big one called the *thalla kallu* and two smaller ones on either sides locally called *pilla kallu* employed for weight balancing purposes (Fig. 1). In some gears, smaller stones are also used in addition to these three stones. Care is taken so that the gear does not sink much due to the weight as in the trawl net. The average length of the gear is 135 m. The depth range of operation was 6 to 7 m.

While trawling, the two boats run parallel to each other with the gear in between (hence the name pair-trawling). Each trawler will be holding one end of the mouth part of the gear. Both the trawlers will have uniform speed and distance between them while hauling. A single haul may last for 2-3 h in accordance with the availability of the fish.

On 25th August 2011, by pair-trawling heavy landing was observed comprising *Pampus argenteus, Loligo* spp., *Pellona ditchella*, *Thryssa* spp. and *Johnius* spp.(Fig. 2). Eighty units operated on this day and the details are as follows:

Table 1. Details of landings by pair trawling at Sakthikulangara on 25th August 2011

Species	Average catch/unit (kg)	Rate per kg (₹)	Amount realised (₹)
Pampus argenteus	400	160	64,000/-
Loligo spp.	207	165	34,155/-
Others	10	10	100/-
Average amount realised/unit			98,255/-
Average amount for 80 units			7,86,0400/-

Landing of *Alopias pelagicus* (Nakamura, 1936) at Visakhapatnam

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Two specimens of the pelagic thresher shark *Alopias pelagicus* (Nakamura, 1936) were landed at Visakhapatnam Fishing Harbour on 28.06.2011. One specimen was male (Fig. 1) and the other was female. The male pelagic thresher shark measured 940 mm and weighed 900 g. The female measured 829 mm (caudal fin tip was absent) and weighed 750 g. The specimens were characterised by large eye size and very long upper lobe of caudal fin. According to Compagno (1984) and Fisher and Bianchi (1984), the pelagic thresher is ovoviviparous, with at least two young, born at a length greater than 96 cm. Based on this information, the two specimens of pelagic thresher sharks landed at Visakhapatnam can be considered as either newborn or foetus. The various morphological measurements (based on Compagno, 1984) of the two specimens are presented in Table 1.

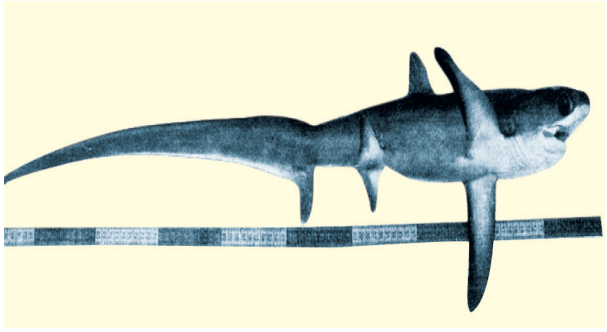

Fig. 1. Male thresher shark *Alopias pelagicus* landed at Visakhapatnam

Table 1. Morphometric measurements of *Alopias pelagicus* landed at Visakhapatnam Fishing Harbour

Measurements (mm)	Male specimen	Female specimen
Total length	940	829
Fork length	462	431
Pre-caudal length	445	389
Pre-first dorsal length	245	217
Pre- pectoral length	155	149
Pre-pelvic length	335	294
Pre-anal length	410	369
Interdorsal space	108	93
First dorsal length	60	49
Second dorsal length	17	19
Pelvic length	54	46
Anal length	19	22
Dorsal caudal margin	505	439*
Eye length	32	24
Eye height	34	25
Clasper outer length	20	-
Total weight (g)	900	750

*denote incomplete measurement as caudal tip was absent

Huge diamond back squid (*Thysanoteuthis rhombus*) landed at Munambam Fisheries Harbour

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A large diamond back squid *(Thysanoteuthis rhombus)* was landed by trawlnet at Munambam Fisheries Harbour on 24.8.2011 (Fig. 1). The net was operated at a depth of 120 m. The total length of the specimen was 107 cm, width - 64 cm, and weight - 13.5 kg.

Fig. 1. *Thysanoteuthis rhombus* landed at Munambam Fisheries Harbour

Fishery activities affected in the Raigad region due to collision of two ships near Mumbai coast

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On 7th August 2010, two ships *viz*., MV Chitra and MV *Khaljia* collided near Mumbai coast. State Government issued a high alert warning to the local people on consumption of fish caught from the sea and its ill effects. Besides this, there were numerous media reports published in the local news papers also about the incident and its after effects.

In the beginning of the incident, many people were scared to eat sea fish, which automatically affected the prices of the fishes brought to the local markets

by the fishermen. Inspite of the state Government warning, regular catches of dolnets / boxnets and hand trawling were reported at Alibag, Thal, Saswane, Mandwa, and Rewas jetty landing centres during this period.

No oil spill or fish mortalities were noticed in the Raigad District except in Uran Taluka, where marine life as well as mangroves and other plants were affected due to spillage of oil and hazardous chemicals.

Observations of the coastal area consequent to collision of two ships near the Gateway of India, Mumbai

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A visit was undertaken in and around Alibag which was reportedly affected as a result of spillage of oil in the sea due to collision of two ships near JNPT Port. It was noticed that there were huge quantities of tea/coffee powder bags, biscuit packets and empty plastic bags soiled with oil, spread all over the beach area of Navgaon, Thal, Mandwa, Saswane and Rewas Bodni. At Saswane, two containers full of tea, coffee and biscuit packets were washed ashore. At Mandwa, two huge containers were found floating around the beach area. At Rewas Bodni and Navkhar, approximately 45 bottles found containing phosphine tablets with label printed on the bottle as: "Manufacturer: United Phosphorous Limited, 167, Dr. A. B. Road, Worli, Mumbai-18, Factory: 3-11 GIDCO, Gujarat, India", were seized by the Mandwa Coastal Police on 10th and 11th August, 2010.

Many local villagers were found collecting the tea/ coffee powder packets from the sea and drying them on the beaches. The local people were made aware of the hazardous nature of the contaminated material floating in the sea due to spillage of oil/chemical from the collided ships.

Oil spill from the ship MV *Rak* at Raigad region of Maharashtra

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Unlike the collision of the ships MV *Chitra* and MV *Khalijia* near JNPT port on 7th August 2010, the ship MV *Rak* sunk with 60,000 t of coal and 343 t of oil and the oil started leaking from the ship near Mumbai coast. The oil slick was seen in most of the places at Raigad region and it affected most of the beaches like Korlai, Borli-Mandla, Nandgao, Tara Bandar, Thal and Saswane and a large number of tar balls and oil patches were noticed on the beaches during the month of August 2011. At Nandgao Landing Centre, two gillnet boats which went for fishing, returned with no fish catch and the nets were full of tarballs and oil.

Fig. 1. Oil spill affected beach at Raigad region

Landing of giant devil rays at Chennai Fisheries Harbour

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Three numbers of giant devil rays, *Manta birostris* (Fig. 1), locally called as "kombu thirukkai" along with the lesser devil ray, *Mobula diabolus* (Fig. 2) were landed by mechanised gillnet at Chennai Fisheries Harbour on 04-06-2011 (Table 1).

Subsequently on 09-06-2011, six numbers of *M. birostris* (DW 420-450 cm) were landed by mechanised gillnet and these were auctioned for ₹ 1,00,000/-. *M. birostris* and *M. diabolus* were sold at a high price owing to the high value of the gillrakers. The gillrakers were removed, cleaned thoroughly and dried for about 4 - 5 days. The dried gillrakers are sold at the rate of ₹ 2,500 – 5,000 per kg depending upon their size. The dried gillrakers are exported and used for soup preparation and for medicinal purpose.

Table 1. Details of size, weight and price particulars of *Manta birostris* landed at Chennai

Disc Width (cm)	Disc length (cm)	Sex	Weight (kg)	Price (₹)
560	255	Female	1000	22,600
532	244	Male	800	16,400
480	240	Male	600	10,200

Fig. 1. *Manta birostris* landed at Chennai

Fig. 2. *Mobula diabolus* landed at Chennai